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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/014,418	12/14/2001	Katsumi Nakagawa	35.C16024	9769
5514 7590 11/20/2003 FITZPATRICK CELLA HARPER & SCINTO 30 ROCKEFELLER PLAZA NEW YORK, NY 10112			EXAMINER SONG, MATTHEW J	
			ART UNIT	PAPER NUMBER

1/65

DATE MAILED: 11/20/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	10/014,418	NAKAGAWA ET AL.	
	<b>Examiner</b>	<b>Art Unit</b>	
	Matthew J Song	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.135(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 02 September 2003.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-52 is/are pending in the application.
- 4a) Of the above claim(s) 12-25 and 38-51 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-11, 26-37 and 52 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All    b) ☐ Some \*    c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.  
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                  | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____  |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)         | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ | 6) <input type="checkbox"/> Other:  |

## **DETAILED ACTION**

### ***Election/Restrictions***

1. Applicant's election with traverse of Group I in the Paper filed on 9/2/2003 is acknowledged. The traversal is on the ground(s) that there would be no undue burden on the Examiner in examining both groups in a single application. This is not found persuasive because a serious burden exists in the differing issues likely to arise during the prosecution of the different statutory classes of the invention.

The requirement is still deemed proper and is therefore made FINAL.

2. Claims 12-25 and 38-51 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected invention, there being no allowable generic or linking claim. Applicant timely traversed the restriction (election) requirement in the Paper filed on 9/2/2003.

3. This application contains claims 12-25 and 38-51 drawn to an invention nonelected with traverse in the Paper filed on 9/2/2003 . A complete reply to the final rejection must include cancellation of nonelected claims or other appropriate action (37 CFR 1.144) See MPEP § 821.01.

### ***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 27-29, 33-37 and 52 are rejected under 35 U.S.C. 103(a) as being unpatentable over O'Neill (US 4,243,472) in view of Dauncey (US 2,759,803).

O'Neill discloses a method for liquid phase epitaxy of multiple wafers, note entire reference, comprising a crucible **14** filled with a melt material **16** to be epitaxially deposited on substrates (col 2, ln 15-35). O'Neill also discloses a substrate holder **10** and supporting a plurality of wafers **12** substantially horizontal and lowering and immersing the wafers into a melt to deposit a thin film on each wafer (col 1, ln 60-68) using a dipping rod member **18** connected at one end to a means for raising and lowering the substrate into the crucible (col 2, ln 36-67). O'Neill also discloses the substrate is disposed at a position set aside from the center of the crucible (Figs 2-4). O'Neill also discloses continually oscillating **30** the wafers through substantially 360°C (col 2, ln 1-2, col 4, ln 10-20 and Figs 2-4); this reads on applicant's rotation of the supporting rack. O'Neill et al also teaches any apparatus capable of supporting and

dipping a plurality of substrate in a melt filled crucible may be used so long as the apparatus is capable of raising, lowering and oscillating the substrate while in the flux (col 2, ln 29-34).

O'Neill does not disclose no part of the substrate is disposed at the center of rotation of the supporting rack. However, O'Neill is open to using other support apparatuses.

In an apparatus for growing crystals, note entire reference, Dauncey teaches a supports **1** used for mounting crystals in a crystal growing tank. The support comprises a shaft **2** to which circular horizontal shelves are secured by struts projection from collars on the shaft. The support may be rotated about the longitudinal axis of the shaft and no part of the substrates are disposed at the center of rotation of the supporting rack (Figs 1-2 and col 2, ln 45 to col 3, ln 25). Dauncey also teaches a winch **19** for withdrawing the support and lowering the support (col 3, ln 25 to col 4, ln 20).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify O'Neill with Dauncey's support rack because a larger number of substrates can be supported, which increasing productivity.

Referring to claims 28 and 34, the combination of O'Neill and Dauncey teaches the substrates are arranged substantially horizontal, this reads on applicant's substantially parallel to the flow of the melt.

Referring to claim 29, the combination of O'Neill and Dauncey is silent to the flow of the melt is caused by the rotation of the supporting rack. This is inherent to the combination of O'Neill and Dauncey because the combination of O'Neill and Dauncey teaches a similar method of rotating the supporting rack, as applicant.

Referring to claim 33, the combination of O'Neill and Dauncey discloses raising and lowering the substrates into the crucible (col 2, ln 35-41).

Referring to claim 35, the combination of O'Neill and Dauncey discloses a group of substrates arranged keeping stated intervals one another in the direction which falls at right angles with the axis of the center of rotation of the supporting rack ('803 Fig 1 and Fig 2).

Referring to claim 36-37, the combination of O'Neill and Dauncey teaches the substrate comprises a plurality of groups independent from one another and all groups are immersed in the same melt and the plurality of groups of substrates are disposed around the axis at the center of rotation of the supporting rack ('803 Figs 1-2).

Referring to claim 52, the combination of O'Neill and Dauncey discloses immersing the substrate in a substrate holder into a melt held in a crucible to grow a crystal by the liquid phase epitaxial method and the substrate holder is rotated.

6. Claim 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over O'Neill (US 4,243,472) in view of Dauncey (US 2,759,803) as applied to claims 27-29, 33-37 and 52 above, and further in view of Ukiyo et al (JP 11-199376), as English Abstract has been provided.

The combination of O'Neill and Dauncey teaches all of the limitations of claim 31, as discussed previously, except a flow adjusting means is provided rotatably in the melt to make the flow of the melt inclined toward the center of rotation and/or the liquid surface of the melt.

In a liquid phase growing method, Ukiyo et al teaches melting a semiconductor and stirring structure independent of a substrate supporting stand and capable of carrying out the rotation and stirring independent of the supporting stand. Ukiyo et al also teaches the shape of a

fin, this reads on applicant's flow adjusting means, for stirring is a twisted rectangular shape and the attaching angle thereof to the substrate supporting stand is 45° (Abstract and Fig 2). The shape of the fin, note Fig 2a, would inherently direct the melt toward the center of rotation. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of O'Neill and Dauncey with Ukiyo et al's flow adjusting means to provide a liquid phase growing method by which efficient and homogeneous liquid phase growth on a substrate is enabled (' 376 Abstract)

7. Claim 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over O'Neill (US 4,243,472) in view of Dauncey (US 2,759,803) as applied to claims 27-29, 33-37 and 52 above, and further in view of Kokta et al (US 4,293,371)

The combination of O'Neill and Dauncey teaches all of the limitations of claim 32, as discussed previously, except supporting rack is rotated alternately in the clockwise and anticlockwise directions.

In a liquid phase epitaxial (LPE) method of growth, note entire reference, Kokta et al teaches the LPE technique is practiced under isothermal conditions and a common practice is to continuously rotate or oscillate the immersed wafer substrate in a plane parallel to the surface of the melt during growth in order to achieve essentially uniform growth over the wafer surface (col 1, ln 20-40). Kokta et al also teaches a heated substrate is rotated at 80 rpm (2 revolution clockwise, then 2 revolutions counter clockwise) (col 4, ln 10-35). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of

O'Neill and Dauncey with Kokta et al's oscillating the substrate to improve the uniformity of growth over the wafer.

8. Claims 1-3, 7-11 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over O'Neill (US 4,243,472) in view of Dauncey (US 2,759,803) as applied to claims 27-29, 33-37 and 52 above, and further in view of Kokune et al (US 5,603,762) or Admission.

The combination of O'Neill and Dauncey teaches a method for liquid phase epitaxy of multiple wafers, note entire reference, comprising a crucible **14** filled with a melt material **16** to be epitaxially deposited on substrates (col 2, ln 15-35). O'Neill also teaches a substrate holder **10** and supporting a plurality of wafers **12** substantially horizontal and lowering and immersing the wafers into a melt to deposit a thin film on each wafer (col 1, ln 60-68) using a dipping rod member **18** connected at one end to a means for raising and lowering the substrate into the crucible (col 2, ln 36-67). O'Neill also discloses the substrate is disposed at a position set aside from the center of the crucible (Figs 2-4) and no part of the substrate is disposed at the center of rotation of the supporting rack ('803 Figs 1-2).

The combination of O'Neill and Dauncey does not disclose the step of rotating the crucible independently from the substrate.

In a method of liquid phase epitaxy, note entire reference, Kokune et al teaches a melt is placed in a furnace and utilized for liquid phase epitaxial growth (col 5, ln 40-60). Kokune et al also teaches the melt held in a crucible is stirred by the rotation of the crucible and when a raw material for the melt is to be melted in the crucible, this mixture is placed in the crucible a stirring shaft is inserted downwardly into the crucible and the mixture is stirred by the shaft



(col 6, ln 50 to col 7, ln 5). Kokune et al also teaches a crucible is fixed onto a table **13** and the table is rotated by a motor, so that the melt is stirred inside the crucible (col 7, ln 15-40). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of O'Neill and Dauncey with Kokune et al's rotation of the crucible to stir the melt, thereby improving the uniformity of the melt.

Admission teaches the rotation of crucible is applied in a liquid phase growth system. Admission also teaches the substrate is stationary and rotating only the crucible can make the substrate supporting means greatly simple and is advantageous for large sized liquid phase growth systems. Admission also teaches when the crucible is rotated the in-plane distribution of growth rate is good (pg 8). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify O'Neill with Admission because rotating the crucible improves the in-plane distribution of growth rate.

Referring to claim 2, the combination of O'Neill, Dauncey and Kokune or the combination of O'Neill, Duancey and Admission teaches a substrate holder **1**, this reads on applicant's supporting rack, and the holder is disposed so that the wafers are held substantially horizontal, this reads on applicant's in the direction substantially parallel to the flow of the melt in the crucible.

Referring to claim 3, the combination of O'Neill, Dauncey and Kokune or the combination of O'Neill, Duancey and Admission teach a rotation of the melt.

Referring to claim 7, the combination of O'Neill, Dauncey and Kokune or the combination of O'Neill, Duancey and Admission teach raising and lowering the substrate holder ('472 col 2, ln 30-50).

Referring to claims 10-11, the combination of O'Neill, Dauncey and Kokune or the combination of O'Neill, Duancey and Admission teaches the substrate comprises a plurality of groups independent from one another and all groups are immersed in the same melt and the plurality of groups of substrates are disposed around the axis at the center of rotation of the supporting rack ('803 Figs 1-2).

9. Claims 4 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over O'Neill (US 4,243,472) in view of Dauncey (US 2,759,803), and further in view of Kokune et al (US 5,603,762) or Admission as applied to claims 1-3, 7-11 and 26 above, and further in view of Igarashi et al (JP 11-228250), an English abstract has been provided.

The combination of O'Neill, Dauncey and Kokune or the combination of O'Neill, Duancey and Admission teaches all of the limitations of claim 4, as discussed previously, except a flow adjusting means is provided stationarily in the melt to make the flow of the melt inclined toward the center of rotation and/or the liquid surface of the melt.

In a method of crystal growth, Igarashi et al teaches a baffle plate 5 is attached to the inner peripheral surface of crucible 4, this reads on applicant's flow adjusting means provided stationarily in the melt, in a state inclined so that the upper side of the baffle plate become front side in the rotation direction of the crucible and then the crucible is rotated (Abstract). The inclined surface of the baffle plate, note Figs 2-3, inherently will direct the flow of the melt toward the center of rotation. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of O'Neill, Dauncey and Kokune or the combination of O'Neill, Duancey and Admission with Igarashi et al's baffle plate attached to the

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crucible to remove suspended matter on the melt surface, thereby increasing purity ('280 Abstract).

10. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over O'Neill (US 4,243,472) in view of Dauncey (US 2,759,803), and further in view of Kokune et al (US 5,603,762) or Admission as applied to claims 1-3, 7-11 and 26 above, and further in view of Ukiyo et al (JP 11-199376), as English Abstract has been provided.

The combination of O'Neill, Dauncey and Kokune or the combination of O'Neill, Duancey and Admission teaches all of the limitations of claim 5, as discussed previously, except a flow adjusting means is provided rotably in the melt to make the flow of the melt inclined toward the center of rotation and/or the liquid surface of the melt.

In a liquid phase growing method, Ukiyo et al teaches melting a semiconductor and stirring structure independent of a substrate supporting stand and capable of carrying out the rotation and stirring independent of the supporting stand. Ukiyo et al also teaches the shape of a fin, this reads on applicant's flow adjusting means, for stirring is a twisted rectangular shape and the attaching angle thereof to the substrate supporting stand is 45° (Abstract and Fig 2). The shape of the fin, note Fig 2a, would inherently direct the melt toward the center of rotation. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of O'Neill, Dauncey and Kokune or the combination of O'Neill, Duancey and Admission with Ukiyo et al's flow adjusting means to provide a liquid phase growing method by which efficient and homogeneous liquid phase growth on a substrate is enabled (' 376 Abstract)

11. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over O'Neill (US 4,243,472) in view of Dauncey (US 2,759,803), and further in view of Kokune et al (US 5,603,762) or Admission as applied to claims 1-3, 7-11 and 26 above, and further in view of Burkhart et al (US 5,902,394).

The combination of O'Neill, Dauncey and Kokune or the combination of O'Neill, Duancey and Admission teaches all of the limitations of claim 6, as discussed previously, except the crucible is rotated alternately in the clockwise and anticlockwise directions.

In a method of oscillating a crucible rotation, note entire reference, Burkhart et al teaches a mechanism capable of rotating a crucible at various rates of rotation and varying the rates of rotation during a given period such that particles contained in the melt are reduced (col 2, ln 5-45). Burkhart et al also teaches the rate of rotation is controlled to alternate between a forward rate of rotation (clockwise) and a reverse rate of rotation (counter clockwise) (col 4, ln 55-67). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of O'Neill, Dauncey and Kokune or the combination of O'Neill, Duancey and Admission with Burkhart et al's oscillating crucible rotation between clockwise and counter clockwise rotation to reduce particles in a melt, thereby improving the quality of the crystal produced.

#### ***Response to Arguments***

12. Applicant's arguments with respect to claims 1-11, 26-37 and 52 have been considered but are moot in view of the new ground(s) of rejection.

***Conclusion***

13. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

O'Neill (US 4,191,365) teaches a horizontal substrate holder for liquid phase epitaxy, note entire reference.

Iwane et al (US 2002/0108559) is a publication of application 10/022,545 to applicant, which teaches similar features as claimed, note entire reference.

14. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

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15. Any inquiry concerning this communication or earlier communications from the  
should be directed to Matthew J Song whose telephone number is 703-305-4953. Th  
can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examine  
supervisor, Nadine Norton can be reached on 703-305-2667. The fax phone numbe  
organization where this application or proceeding is assigned is 703-872-9306.

Any inquiry of a general nature or relating to the status of this application or  
should be directed to the receptionist whose telephone number is 703-308-0661.

Matthew J Song  
Examiner  
Art Unit 1765

MJS

NAD  
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